

REMARKS

A. Introduction

Claims 50-60 and 77-85 were pending in the application at the time of the Office Action. The Office Action rejected claims 50-60 and 77-85 as being obvious over cited art. By this response Applicant has cancelled claims 52 and 83 and amended independent claims 50 and 81 to respectively incorporate the limitations of the cancelled claims, which previously depended from claims 50 and 81. Applicant has also herein added new claims 86-89. Support for the new claims can be found in the specification at least at page 14, line 21 through page 16, line 4. As such, Applicant submits that the amendments to the claims do not introduce new matter and entry thereof is respectfully requested. Claims 50, 51, 53-60, 77-82, and 84-89 are presented for the Examiner's consideration in light of the following remarks

B. Rejection on the Merits

Pages 2-9 of the Office Action reject claims 50-60 and 77-85 under 35 USC § 103(a) as being obvious over U.S. Patent Application Publication No. 2002/0195619 to Makimoto et al. (“*Makimoto*”) in view of an article titled “Low-Resistance Nonalloyed Ohmic Contact to p-type GaN Using Strained InGaN Contact Layer,” by Kumakura et al. (“*Kumakura*”). Applicant respectfully traverses this rejection.

As shown in Figure 10, *Makimoto* discloses a p-type InGaN base layer 106 with a Pd/Au base electrode 109 being formed directly on the p-type InGaN base layer 106. As conceded by the Examiner, *Makimoto* fails to disclose “an indium-containing p-type nitride semiconductor layer formed directly on the p-type base layer... and a base electrode formed over said indium-containing p-

type nitride semiconductor layer,” as recited in independent claims 50 and 81. The Examiner then points to *Kumakura* to remedy this deficiency of *Makimoto*.

As shown in Figure 1, *Kumakura* discloses the insertion of a p-type InGaN layer between a p-type GaN layer and a Pd/Au electrode. The Examiner states that “it would have been obvious ... to insert a p-type InGaN contact layer between Pd/Au and p-type GaN as taught by Kumakura et al. in the device structure of Makimoto in order to improve the device performance by reducing the resistance contacts (see Kumakura et al.: pg. 2588; column 1, paragraph 2).”

Applicant concedes that *Kumakura* teaches inserting a p-type InGaN contact layer between the base layer and the contact for the reason cited by the Examiner, that of “improv[ing] the device performance by reducing the resistance contacts.” However, Applicant submits that the same benefits would not occur if the InGaN contact layer of *Kumakura* was added to the semiconductor structure disclosed in *Makimoto*. *Kumakura* discloses that “it is difficult to obtain ohmic contact to p-type GaN with low specific contact resistance ...” p. 2588, col. 1, emphasis added. *Kumakura* further explains that “p-type InGaN is one of the most promising materials to reduce the contact resistance because it has a narrower band gap than GaN and a high hole concentration...” p. 2588, col. 1. Based on this, *Kumakura* discloses that a reduction in ohmic contact resistance was obtained by adding the InGaN contact layer between the electrode and the p-type GaN base layer. See Abstract. In other words, the reason that contact resistance with the *Kumakura* electrode was less was because the electrode was formed directly on a p-type InGaN contact layer instead of the p-type GaN base layer.

In contrast, as noted above the base layer of *Makimoto* is not a p-type GaN layer, but is instead a p-type InGaN layer. Thus, the base electrode 109 of *Makimoto* is already formed directly on a p-type InGaN layer. As such, adding a separate p-type InGaN contact layer between the p-type InGaN base layer 106 and the electrode 109 would not yield the benefits recited in *Kumakura*. That

is, no lessening of ohmic contact resistance would occur, as the electrode is already formed on a p-type InGaN layer. Instead, adding a separate p-type InGaN contact layer would simply add cost and complexity to the Makimoto device without adding any appreciable benefits. As such, Applicant submits that it would not have been obvious to add a p-type InGaN contact layer as disclosed by *Kumakura* to the *Makimoto* semiconductor structure.

In view of the foregoing, Applicant submits that a *prima facie* case of obviousness has not been established. Accordingly, Applicant respectfully requests that the obviousness rejection of claims 50, 51, 53-60, 77-82, 84, and 85 be withdrawn.

No other objections or rejections are set forth in the Office Action.

D. New Claims

Applicant submits that new claims 86-89 are distinguished over the cited art of record. For example, the contact layer disclosed in *Kumakura* “varied from 2 nm to 15 nm,” with the 2 nm thick layer showing the lowest contact resistance. See Abstract. Because the goal of *Kumakura* is to lower the contact resistance, one of skill would not be motivated to increase the thickness beyond that disclosed in the reference. Thus, none of the cited art discloses or suggests “the p-type nitride semiconductor layer has a thickness of about 100 nm,” as recited in new claims 87 and 89.

In addition, new claims 86-89 depend from claim 50 or 81 and thus incorporate the limitations thereof. As such, Applicant submits that new claims 86-89 are also distinguished over the cited art for at least the same reasons discussed above regarding claim 50 and 81.

C. Conclusion

Applicant notes that this response does not discuss every reason why the claims of the present application are distinguished over the cited art. Most notably, applicant submits that many if not all of the dependent claims are independently distinguishable over the cited art. Applicant has merely submitted those arguments which it considers sufficient to clearly distinguish the claims over the cited art.

In view of the foregoing, applicant respectfully requests the Examiner's reconsideration and allowance of claims 50, 51, 53-60, 77-82, and 84-89 as amended and presented herein.

In the event there remains any impediment to allowance of the claims which could be clarified in a telephonic interview, the Examiner is respectfully requested to initiate such an interview with the undersigned.

Dated this 25th day of February 2008.

Respectfully submitted,

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